This document contains Appendix C from the 2004 Norwegian Star Data Report. Appendix C contains interview results for activities that impact wastewater generation onboard the Norwegian Star. The report and all the appendices for this sampling event can be downloaded from ***http://www.epa.gov/owow/oceans/cruise_ships/finalstar.html***

Norwegian Star

2004 Analytical Results

Appendix C

March 2006

Appendix C

INTERVIEW RESULTS FOR ACTIVITIES THAT IMPACT WASTEWATER GENERATION

GRAYWATER GENERATION DATA SHEET

Vessel: Norwegian Star
Date: 8/9/04
Recorded By: Donald F Anderson
Vessel Point(s) of Contact: Environmental Officer (EO): Ioannis Kollaros

Robert Brand: Food and Beverages Director

Number of Passengers and Number of Crew Actually on Board:
Passengers: **2,591**
Crew: **1,144**

Unusual Maintenance or Operational Activities Described By Vessel Point(s) of Contact:
- No major events reported during sampling episode

Number and Time of Meals Served by Day (include passengers and crew) :
Breakfast: Provisions planned for ~4 meals/day/person; ~15,000 meals/day
Lunch: Average passenger age ~46-47
Dinner:
Other Meals:

- Versailles dining rm: 440 persons/sitting; Aqua dining rm: 360 persons/sitting; total both restaurants: ~1,600 for dinner
- Market Café: ~1,900 breakfast; ~1,400 - lunch; ~550 - dinner
- Blue Lagoon: ~500 meals/day
- Other restaurants: ~500+ meals/day
- Most preliminary food preparation (baking breads, desserts, precooking meats, etc.) done in galley facilities on Decks 3 and 4; food brought up to large restaurant galleys for balance of preparation and "plating;" all meats handled in separate areas: poultry, red meat, seafood; all food storage (frig / temps, freezers) specific to food type; appeared to be clean, nicely kept
- Cleaning chemical use the same in every galley; generally five chemicals for all machines are auto-dosed, plus hand washing and others used as necessary (e.g., bleach, lime away [muriatic acid]), kept in lockers, and MSDSs available in each galley
  - hoods/vents (Gaylord system), sink drains cleaned on regular schedule (~weekly, or as necessary w/ Gamazyme); hood/vent wastes and sink/trap wastes discharged to GW system
- Cooking oils NOT discharged to GW system; taken off for shore disposal as nonhazardous waste

Were **Dishwashers** Operated? **Yes** / No (Circle one) Yes, in all galleys

If yes, what weight, number of pieces, or number of loads were washed? Not available
What times were dishes washed by day? During and after each meal; others (e.g., Blue Lagoon), ongoing as necessary
Estimated volume of water per load: ~25-30 gal/load; all galleys/bars: 11 dishwashers, 16 glass washers, 4 pot washers; room service / bell box pantries: 14 glass washers
Galley food pulpers: Scanship; wastewater collected in holding tank 15 Pfwd, <u>not</u> treated in Scanship blackwater/graywater treatment system; discharged overboard at sea >12 nm every few days

Ralph Lawson, Executive Housekeeper

Was **Laundry** Washed? (Circle one) **Yes** / No

If yes, number of hours per day laundry was operated: ~12 hrs, except longer prior to turn-around days / ports (Seattle)
Weight, number of pieces, or number of loads washed per day:
- number of pieces not known; machines operated filled

What times was laundry operated each day? ~1100 - 2300
Estimated volume of water per load: see below
Are there floor drains in the laundry? Yes What and where do they drain? GW system

Detergent and other chemicals names (obtain MSDS if available):
- six chemicals are auto-dosed for all machines according to menu of material types; all machines chemicals dosed from central fenced station w/ diking; CLEAN; NCL personnel indicate chemical procurement through corporate HQ and use consistent throughout fleet
- eight large machines; ~15 loads/day, 50 liters water used/load
- two small machines; ~six loads/day, 25 liters/load

- Dry cleaning: self-contained machine w/ internal distilling/recycle and thus extremely low annual use of perchloroethylene (perc); four loads per day; staff indicates no condensate from distillation; however, this is not likely; given other waste management practices, condensate from distillation probably removed for shore disposal, but could not be verified

Other Sources (e.g., small pantries, steward stations, cleaning stations):
- five crew launderettes; number of washing machines per launderette (est. six), loads/day, and water use/load not known, but each machine probably similar to small machines in commercial laundromats
- five room service pantries

Times these sources are generated: Crew: varies, all day
Estimated volume per source: see above

SPECIAL WASTES GENERATION AND DISPOSITION DATA SHEET

Vessel: Norwegian Star
Date: 8/11/04
Recorded by: Donald F Anderson

Photo Lab(s) On Board: yes or no (circle one) Yes
Two film developing machines; one digital machine
Waste handling and disposition:

- Waste developers (see below), fixers, etc., held in PE containers for shore disposal

Any waste treatment (e.g., silver recovery in photo lab)? What is the disposition of treated waste and any residuals (e.g., silver recovery filter and filtrate)?

- tandem recovery cylinders for silver; each cylinder replaced after ~500 hrs use (3-4 months); operated on timer to prevent overflow
- recovery filter cylinders sent to vendor for silver reclaim
- developer recovery: Silver < 2 mg/l; other wastewaters: Silver > 5 mg/l - shore disposal as hazardous waste; <5 mg/l - disposed to GW system

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains. No floor drains

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water? What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?

- One sink open for hand washing, rinsing; discharges to GW system
- No regular developing wastewater disposal in sink

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment? No. No secondary containment

Print Shop(s) On Board: yes or no (circle one) Yes

Waste handling and disposition: Solvents - excess in wipes/rags, shore disposed as HW; Activators, stabilizers, inks - dispose as HW once to twice / yr

Any waste treatment? What is the disposition of treated waste and any residuals? None

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains. No floor drains

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water? What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?

- One sink open for hand washing, rinsing; discharges to GW system
- No developing / cleaning wastewater disposal to GW system

Dry Cleaning On Board: yes (see laundry discussion on page C-2)

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment?
- Floor, shelves, locker, as appropriate/necessary
- No secondary containment

Chemical Storage Area On Board: yes or no (circle one) Yes

Waste handling and disposition: Any spills from engine room storage areas go to bilge; bilge compartments generally segregated and pumpable

Any waste treatment? What is the disposition of treated waste and any residuals? None

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains. No floor drains in storage rooms on decks above engine room; all such rooms locked, limited access, well kept.

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water? What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)? No sinks

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment?
- Store rooms on Deck 3 and 4 - hotel chemicals (e.g., detergents, bleach, etc), metal cleaning, etc. - separate rooms and/or separated locations and shelving within a room for acids / alkalines / reactives; shelves w/ restraint bars and nonslip surfaces; some rooms included small dikes; MSDSs available; well done!
- Engine room stores - degreasers, defoamers, paints, other "industrial use" and water treatment chemicals (hypochlorite), etc.; no secondary containment; see above

Medical Infirmary On Board: yes or no (circle one) Yes

Waste handling and disposition: Shore disposal of sharps and other medical wastes as HW

Any waste treatment? What is the disposition of treated waste and any residuals? None

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains. No floor drains

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water? What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)? Sinks to GW system; toilets to BW system

Inspect area for chemical storage. Are chemicals stored over a sump or other secondary containment? Xray developer/fixer; taken by EO, shore disposal as HW; no secondary containment

Garbage Room On Board: **yes** or no (circle one) Yes

Waste handling and disposition:
Spent batteries, crushed glass, shredded plastic, metal cans, baled unbleached box board, etc., to shore disposal (Victoria, BC; Seattle)

Any waste treatment? What is the disposition of treated waste and any residuals?
All garbage is sorted / separated for recycle by Scanship equipment; extensive (~complete) recycle of crushed / dewatered metals, glass, plastics, unbleached box board; see NCL policy statements (attached); garbage not recyclable held in refrigerated storage

Inspect area for floor drains. Are drains blocked or open? Where do the floor drains lead? Describe any streams that enter the floor drains.
Drains from container dewatering to bilge; treated by OWS

Inspect area for sinks. Is sink drain blocked or open? What is the disposition of sink water? What streams enter or potentially the sink (e.g., hand washing, rinse/clean equipment, prepare chemical solutions)?
Two sinks (hand washing only), discharge to GW system

PESTICIDE, FUNGICIDE, AND RODENTICIDE USE DATA SHEET

Vessel: Norwegian Star
Date: 8/11/04
Recorded by: Donald F Anderson

- NCL procedures / policies regarding pest control (attached); targeted treatment as required; licensed use of *only* Siege gel primarily for cockroaches; flies - light traps; no rats

Pesticides Used On board: yes or no (circle one) Yes

Pesticide Name	Target Pest(s)	Amount Used/yr	MSDS Obtained (yes/no)
Siege Gel _____	_____	_____	Yes _____
_____	_____	_____	_____
_____	_____	_____	_____

List Locations Where Pesticides are Normally Applied and Stored On Board and Dates Applied:
Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)? One locker for storage of Siege gel insecticide (MSDS); floor drain and sink drains to GW system
Person(s) Responsible for trap / pesticide application: Ralph Lawson; Executive Housekeeper

Fungicides Used On board: yes or **no** (circle one) No

Fungicide Name	Target Fungi	Amount Used/yr	MSDS Obtained (yes/no)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

List Locations Where Fungicides are Normally Applied and Stored On Board and Dates Applied:
Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)?
Person(s) Responsible for Fungicide Application:

Rodenticides Used On board: yes or **no** (circle one) No

Rodenticide Name	Target Rodent	Amount Used/yr	MSDS Obtained (yes/no)
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

List Locations Where Rodenticides are Normally Applied and Stored On Board and Dates Applied:
Potential to Enter Graywater/Blackwater Systems (e.g., application, spills, floor drains)?
Person(s) Responsible for Rodenticide Application:

COLLECTION, HOLDING, AND TRANSFER (CHT) TANK DATA SHEET

Vessel: Norwegian Star
Date: 8/12/04
Recorded by: Donald F Anderson

See VSSP for complete listing of holding and double bottom (DB) tanks for blackwater and graywater system

Tank Number or Identification:
Wastewater Source(s):
Tank Volume:_____ m^3 or gallons

Does the Tank Have Vacuum: yes or no (circle one): Blackwater is evacuated from toilets using vacuum system; graywater is gravity system
Vacuum: ____ mm Hg Not known

Tank Material of Construction: Steel; type unknown

Is this a double bottom tank: yes or no (circle one)?
Normal Operating Volume: _____ m^3

Automated Tank Gauging and Discharge System: yes or no (circle one) Yes, but type was not identified

Discharge Type: batch or continuous (circle one)
Totalizer or Flow Meter on Discharge Line: yes or no (circle one); very limited number of flow meters
Discharge Flow Rate: _____ m^3/min or m^3/day
Wastewater Destination After Leaving the Tank:
Approximate Diameter of Discharge Line: _____ inches

Screens or Filters Present on Either Influent or Discharge Lines (describe):

Chemical Additions to Tank: Possibly Gamazyme on periodic basis, but not verified; particularly for tanks receiving sludges and food pulper wastes

Chemical Name	Purpose	Amount	MSDS (yes/no)
_____	_____	_____ kg/day	_____
_____	_____	_____ kg/day	_____
_____	_____	_____ kg/day	_____

Is sludge removed from this tank (describe frequency, amount, destination)?: Periodically cleaned; frequency and method unknown

WASTEWATER TREATMENT UNIT DATA SHEET

Vessel: Norwegian Star
Date: 8/13/04
Recorded by: Donald F Anderson

Description of Treatment Unit: Biological treatment system
Manufacturer: Scanship
Model:

Design Drawings Obtained: yes or no (circle one) Design drawings not received, only simple system schematic of Scanship systems on other NCL ships (excerpted from Scanship Instruction Manual for Sky, Sun) to confirm EPA schematic

Design Capacity: _____ gpd or gpm (circle one)
Typical Operating Flow Rate: _____ gpd or gpm (circle one)
Operational period: _____ hours
Chemical Additions:

Chemical	**Amount**	**Units**	**MSDS Obtained**
Polymer (polyacrylomide)	~2 mg/l, ~9 l/hr		Yes
Flocculant (polyaluminum chloride)	~2 gm/m^3, ~5 l/hr		Yes
Defoamer	~ 3 l/hr		
UV tube cleaner (phosphoric acid)	not known		

Electrical Requirements:
Volts: _____ Amps: _____ Horsepower: _____

Sludge Generation: yes or no (circle one)
If yes, describe frequency, amount, and destination:

- Sludge management includes drying and incineration. However, the drying equipment was not functioning properly (feed auger bearing problems noted) and thus the sludge could not be incinerated.

Was maintenance performed on treatment unit: yes or no (circle one) See below
If maintenance was performed, estimate labor: _____ hours

List operating parameters recorded (e.g., flow, temperature, pressure, pH), typical values, and range for this unit. Record or obtain copy or printout of logs for the duration of the sampling episode.

- Only record obtained is printout of graph of TSS (online turbidity meter).
- Other parameters are tracked on engine control room screens, such as influent flow and pH, flocculant tank pH, after holding tank (18S) flow influent to treatment system, and through DAF tanks, etc. Upon inquiry with engine control room staff, it was determined that stored data (if any) for these other system operating parameters were not available for printing or electronic file download from the Star's computers.
- The only other source for such data, suggested by EO and the engine control room system operator, is Scanship. However, to date no response has been received to request for data/printouts of system operating parameters beyond TSS (turbidity) during sampling episode.
- Bioreactors #1, #2: MLTSS maintained at approx. 9 - 10 gm/l; compressed air blowers (2 + 1 standby) controlled only by throttle valves, intended to maintain DO at ~0.5+mg/l
- Coagulant and flocculant added prior to DAF units; pH controlled to ~ 5.8 - 6
- Cloth mesh on polishing screen filter cleaned weekly
- UV lamp intensity monitored; if >20% drop, automatic cleaning cycle initiated for ~60 min using phosphoric acid; cleaning cycle occurs every ~335 hrs
- Online turbidity sensor (TSS) controls discharge; if <29 mg/l, discharge overboard; if 30 mg/l or greater, valve returns treated effluent to DB tank
- No major equipment / unit ops out of service during sampling episode; maintenance was performed on turbidity sensor, which corresponds to spike in TSS (see graph)
- All equipment checked daily for proper function; alarms in control rm; all system maintenance and repair (as for entire ship) through AMOS
- See Scanship Operation Manual; doc # 000168E; 2003.06.06
- See Operational Guide to Scanship's Wastewater Treatment System onboard M/S Norwegian Sun, 2003.05.14
- Blackwater / Graywater Treatment System Sludges (drum filter solids, DAF solids, polisher solids) - sludge dryer not consistently operational during sampling episode due to bearing problems, and therefore incinerators (two units) not receiving Scanship treatment system sludge

SOURCE WATER DATA SHEET

Vessel: Norwegian Star
Date: 8/13/04
Recorded by: Donald F Anderson

Is Potable Water Generated On Board the Vessel: yes or no (circle one) Yes

- 600 tpd generated by Reverse Osmosis; ~ 35% product, ~65% brine reject
- Remainder of daily volume supplied by on-board multiple effect evaporation
- Fresh water is typically not often bunkered from city water supplies in Alaska

Describe the Onboard Potable Water Treatment and Disinfection Method:

- Chlorination on board the Norwegian Star to PHS stds using hypochlorite w/ muriatic acid acidification; dechlorination w/ sodium bisulfite

Port (City) Where Source Water is Obtained if Not Generated On board: Juneau, Seattle, Victoria; possibly others on itinerary as needed, but not typically

Treatment Method for Source Water Obtained in Port:

- Juneau: Water taken primarily from Last Chance Basin (LCB) well field on Gold Creek; Chlorination and fluoridation are the only treatment this water receives; see http://www.juneau.org/water/h2odistr.php
- Seattle: So. Fork Tolt R. - filtration and ozonation; Cedar R. basin - Ozonation, UV disinfection; see http://www.seattle.gov/util/About_SPU/Water_System/Water_Sources_&_Treatment/Tolt_Treatment_Facility/ABOUTTHE_200401201445304.asp
- Victoria, BC: disinfection using chlorine, ammonia, UV; see http://www.crd.bc.ca/water/

Disinfection Method for Source Water Obtained in Port: See above

Fluoride Added to Water Obtained in Port: yes or no (circle one) See above

Additional Disinfection Performed On Water Obtained in Port: yes or no (circle one)
Yes
Describe Additional On-board Disinfection Method:

- Chlorination on board the Norwegian Star to PHS stds using hypochlorite w/ muriatic acid acidification; dechlorination w/ sodium bisulfite

Description of Source Water Sample Collection Point On Board Cruse Ship:

- See SAP for Norwegian Star and sampling team notes